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Status of the Whooping Crane (Grus americana) in Alberta

Jennifer L. White

Alberta Wildlife Status Report No. 34

Alberta Conservation Association

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PREFACE

Every five years, the Fisheries and Wildlife Management Division of Alberta Natural Resources Service reviews the status of wildlife species in Alberta. These overviews, which have been conducted in 1991, 1996 and 2000, assign individual species 'ranks' that reflect the perceived level of risk to populations that occur in the province. Such designations are determined from extensive consultations with professional and amateur biologists, and from a variety of readily available sources of population data. A primary objective of these reviews is to identify species that may be considered for more detailed status determinations.

The Alberta Wildlife Status Report Series is an extension of the general statusing exercises (1996 *Status of Alberta Wildlife, Status of Wild Species in Alberta* 2000), and provides comprehensive current summaries of the biological status of selected wildlife species in Alberta. Priority is given to species that are potentially at risk in the province (At Risk, May be at Risk), that are of uncertain status (Status Undetermined), or which are considered to be at risk at a national level by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

Reports in this series are published and distributed by the Alberta Conservation Association and the Fisheries and Wildlife Management Division of Alberta Environment, and are intended to provide detailed and up-to-date information which will be useful to resource professionals for managing populations of species and their habitats in the province. The reports are also designed to provide current information which will assist the Alberta Endangered Species Conservation Committee to identify species that may be formally designated as endangered or threatened under the Alberta Wildlife Act. To achieve these goals, the reports have been authored and/or reviewed by individuals with unique local expertise in the biology and management of each species.

EXECUTIVE SUMMARY

The Whooping Crane (Grus americana) is currently ranked 'At Risk' in Alberta, meaning the species is in danger of extirpation from the province. The Alberta Wildlife Act also lists the Whooping Crane as 'endangered.' The purpose of this status report is to compile and summarize both historic and up-to-date information and to update the current status of the Whooping Crane in Alberta.

Whooping Crane reached a world-wide population low of only 15 individuals in a single migrating flock and 6 individuals in a non-migratory flock. Conservation efforts have increased since then to preserve the viability of the species. The migratory flock remains today as the only wild self-sustaining viable population of Whooping Cranes. This flock, currently numbering about 180 individuals, nests in Wood Buffalo National Park along the border between northern Alberta and the Northwest Territories, and migrates almost 4800 km to winter on the Gulf of Mexico coast at the Aransas National Wildlife Refuge in Texas. Today, population numbers are more stable and increasing, and a number of conservation efforts have been undertaken to increase the number of Whooping Cranes in North America.

Management of Whooping Cranes is critical to ensure survival of the species. In order to have a continued population increase, it is necessary to devote research time and financial support to the minimization and mitigation of anthropogenic threats to the species. It is also important to have contingencies in the instance of non-mitigable environmental and biological threats. With careful management of both the wild and captive populations of Whooping Cranes, and with wildlife managers dedicated to attaining the goals and objectives outlined within the recovery plans, we can be hopeful that the species will slowly continue to increase.

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TABLE OF CONTENTS

PREFACE iii

EXECUTIVE SUMMARY iv

ACKNOWLEDGEMENTS v

INTRODUCTION 1

HABITAT 1

CONSERVATION BIOLOGY 2

DISTRIBUTION 3

1. Alberta 3
2. Other Areas 3
    2.1 Wild Populations 3
    2.2 Captive Populations 6

POPULATION SIZE AND TRENDS 6

1. Alberta 6
2. Other Areas 7
    2.1 Wild Populations 7
    2.2 Captive Populations 8

LIMITING FACTORS 8

1. Natural Limiting Factors 8
2. Habitat Loss and Degradation 9
3. Hunting 10

STATUS DESIGNATIONS 11

1. Alberta 11
2. Other Areas 11

RECENT MANAGEMENT IN ALBERTA 11

SYNTHESIS 12

LITERATURE CITED 14

APPENDIX 1 19

INTRODUCTION

The Whooping Crane nests in extreme northern Alberta and the Northwest Territories along both sides of the border. The Alberta birds nest just inside the boundaries of Wood Buffalo National Park near the Northwest Territories Border (Johns 1998b). Historically, there are believed to have been between 1300 and 1400 Whooping Cranes (Grus americana) in North America (Allen 1952). Populations began to decline dramatically in the latter 19th century because of over-hunting, habitat loss, and habitat degradation, and reached a low of only 15 individuals in a single migratory flock. Due to heightened conservation efforts in the latter half of the 20th century, the population numbers have stabilized and are slowly increasing, with approximately 180 individuals currently in the migratory flock that breeds in Wood Buffalo National Park.

According to the *Status of Wild Species in Alberta* 2000 (in prep), the Whooping Crane is considered 'At Risk*' in the province. The Whooping Crane has been a 'Red-Listed'(at risk) species in Alberta since 1991 (Alberta Wildlife Management Division 1996). As well, the Alberta Wildlife Act lists the Whooping Crane as 'endangered' (Wildlife Act 1984). The species has been listed as 'endangered' by COSEWIC since 1978, the first year that species status designations were made (RENEW 1998), and remains on the COSEWIC list of endangered species today. Although the numbers of Whooping Cranes are increasing, the species is still vulnerable because of its relatively small population size.

The Whooping Crane has been widely studied over the past half-century, and there is much information available on its biology and history. The purpose of this status report is to compile and summarize up-to-date information and update the current status of the species in Alberta.

HABITAT

The Whooping Crane has very extensive and specific habitat requirements on its wintering and breeding grounds, and along its migratory route. Current nesting areas are in poorly drained sites where muskeg joins boreal forest (Allen 1956, Novakowski 1966, Kuyt 1981, Meine and Archibald 1996, Timoney 1999), although historically, cranes were believed to have nested in large isolated marshes in prairie and aspen parkland (Gollop 1978).

Whooping Cranes nest primarily in bulrush, sedges or other emergent vegetation in shallow areas of still waters, either ponds, small lakes, or wet meadows (Kuyt 1995). The wetlands are extremely shallow and often separated from one another by narrow ridges, 60 cm to 90 cm in height, supporting dense thickets of willows (Salix sp.), black spruce (Picea mariana), dwarf birch (Betula glandulosa), and tamarack (Larix occidentalis); Allen 1956).

Wintering grounds on the Blackjack Peninsula of the Gulf of Mexico consist of an outer peninsula surrounded by tidal marshes and uplands marked with long, narrow ponds (Johnson 1976). This area is dominated by salt grass (Distichlis spicata), saltwort (Batis maritima), glasswort (Salicornia species), and salt-flat grass (Monanthochloe littoralis) as well as cordgrass (Spartina species; Stevenson and Griffith 1946). The majority of Whooping Cranes winter in brackish bays, estuarine marshes, and tidal flat areas dominated by aquatic vegetation (Allen 1952, Allen 1956, Labuda and Butts 1979, Stehn and Johnson

* See Appendix 1 for definitions of selected status designations.

1987). Whooping Cranes can also use upland habitat, especially when it has been flooded or undergone prescribed-burning (Hunt 1987). While migrating, Whooping Crane habitat requirements can include croplands and grainfields, large or small prairie freshwater marshes, the margins of lakes and reservoirs, and submerged sandbars in rivers (Howe 1989, Johnsgard 1991, Johns 1992, Kuyt 1992, Johns et al. 1997).

It is unknown if Whooping Cranes remain at their current nesting grounds in Wood Buffalo National Park because it represents ideal breeding habitat or if they have been pushed further and further north to the fringe of their historical breeding range to find undisturbed habitat. Historical records indicate that almost all recorded sightings of nesting areas were not in their current northern muskeg habitat but rather in the aspen parkland region, the transitional belt that lies between plains and parklands throughout the Canadian prairies (Allen 1952). Many of the reasons for this shift from traditional to current nesting habitat are described in this report (see Limiting Factors).

CONSERVATION BIOLOGY

The Whooping Crane is North America's tallest bird, with males approaching almost 1.5 m in height and 2.5 m in wingspan (Peterson 1990, Edwards et al. 1994). Males are generally larger than females, with average weights of 7.3 kg and 6.4 kg, respectively (Erickson and Derrickson 1981). Cranes are sexually monomorphic birds, meaning that an individual's sex cannot be determined by the outside appearance. Adult plumage is snowy white with the exception of black primaries on the tips of the wings, and a bright red post-occipital patch (Allen 1952, Erickson and Derrickson 1981).

Whooping Cranes reach sexual maturity at approximately five years of age. Each pair nests in an area averaging 4.1 km^2 but up to 47 km^2 (Kuyt 1981). Whooping Cranes usually nest at least 1 km apart, (Kuyt 1981), but there have been records of adjacent nests as close as 500 m in dense nesting areas along the Klewi River and Preble Creek (B. Johns pers. comm.). Nesting occurs in marshes and nests are built of vegetation including bulrushes and sedge (Edwards et al. 1994). Whooping Crane eggs are light brown to olive in colour with darker brown or purple spots. Incubation is shared by both adults and lasts for 29 to 30 days (Edwards et al. 1994). Cranes usually have a clutch size of two eggs, although one or three eggs are possible. Only one young usually survives to maturity (Edwards et al. 1994). Juveniles vary in colour from rust to cinnamon (Peterson 1990) and are capable of flight at 80 to 90 days (Edwards et al. 1994).

The diet of the omnivorous Whooping Crane consists primarily of mollusks, crustaceans, insects, minnows, frogs, and snakes during the breeding season (Allen 1956, Novakowski 1966). Whooping Cranes winter diet consists of blue crabs, clams, fiddler crabs, shrimp, other aquatic invertebrates and small vertebrates, and plants (Allen 1952, Allen 1956, Labuda and Butts 1979, Stehn and Johnson 1987), and can also include foraging for acorns, snails, insects, and rodents when using more upland habitat (Hunt 1987).

Fall migration begins in late September, when the first birds begin leaving Wood Buffalo National Park (Johnsgard 1991). While migrating, their diet shifts to include waste grains on agricultural lands such as barley and wheat (Meine and Archibald 1996, Johns et al. 1997). They generally begin arriving in Aransas in late October (Johnsgard 1991) and spring migration begins in late March (Meine and Archibald 1996).

DISTRIBUTION

1. Alberta. - The Whooping Cranes in the remaining wild migratory population currently nest in Wood Buffalo National Park, which spans the Alberta-Northwest Territories border (Figure 1). Several pairs nest in Alberta, immediately south of 60° N, but the majority of pairs nest in the Northwest Territories, immediately north of 60° N (Johns 1998b). These birds also pass through northeastern Alberta along their migratory route to and from the wintering grounds in the Aransas National Wildlife Refuge in Texas.

Historically, Whooping Cranes are known to have nested in northern and central Alberta, extending at least as far south as the Battle River (Salt and Salt 1976). They are believed to have established breeding grounds in central Alberta near Killam, Whitford Lake, and Wainwright (Godfrey 1966). In 1977, a Whooping Crane nest was found 5 km south of the Northwest Territories Border (Pinel et al. 1991). Several nests were observed within the Alberta portion of Wood Buffalo National Park again in 1978 and 1979 (Pinel et al. 1991). Prior to this finding, the last known nesting of Whooping Cranes within Alberta was in Wainwright in 1914 (Kuyt 1978). A lone Whooping Crane was sighted in Waterton Lakes National Park in southern Alberta in 1966, however historical records are poor and the probability exists that this sighting was a misidentification (Sadler and Myres 1976).

2. Other Areas

2.1 Wild Populations. - The Whooping Crane's breeding range is believed to have historically extended throughout Alberta from the Arctic coast to Central Mexico and from the Atlantic seaboard to Utah (Allen 1952, Gollop 1978, Edwards et al. 1994). In the latter half of the 19th and the early 20th century, the cranes' range shrank dramatically. At this time, the primary nesting areas were restricted to an extension from central Illinois, through northwestern Iowa, northwestern Minnesota, and northeastern North Dakota, and then extended northwesterly through southwestern Manitoba and southern Saskatchewan into east-central Alberta (Figure 2) (Allen 1952, Gollop 1978, Edwards et al. 1994). By the 1890s, the Whooping Crane was extirpated from the United States portion of its historical breeding range, and the last observation of nesting in the Canadian aspen parklands was in 1929 in south-central Saskatchewan (Meine and Archibald 1996).

Today, three separate wild Whooping Crane populations exist in North America: the Wood Buffalo - Aransas migratory population, remnants of the experimental Sandhill crane cross-fostered population in the Rocky Mountains of the United States, and a recently established experimental non-migratory population on the Kissimmee Prairie in Florida (Meine and Archibald 1996).

Of the three wild populations remaining in North America, only the migratory flock is currently a self-sustaining population (Meine and Archibald 1996). This flock of Whooping Cranes nest in Wood Buffalo National Park in Alberta and the Northwest Territories and winters at the Aransas National Wildlife Refuge, on the Gulf of Mexico's lower Texas coast between Galveston and Corpus Christi (Johnson 1976, Edwards et al. 1994, Meine and Archibald 1996).

The breeding range of the migratory flock of Whooping Cranes is restricted to a small portion of Wood Buffalo National Park approximately 80 km^2 in size, extending along the Little Buffalo, Sass, Klewi, and Nyarling Rivers (B. Johns, pers. comm.). The vast majority of breeding sites are north of 60° N in the Northwest Territories, with several pairs choosing to nest in Alberta (Kuyt 1993, Kuyt

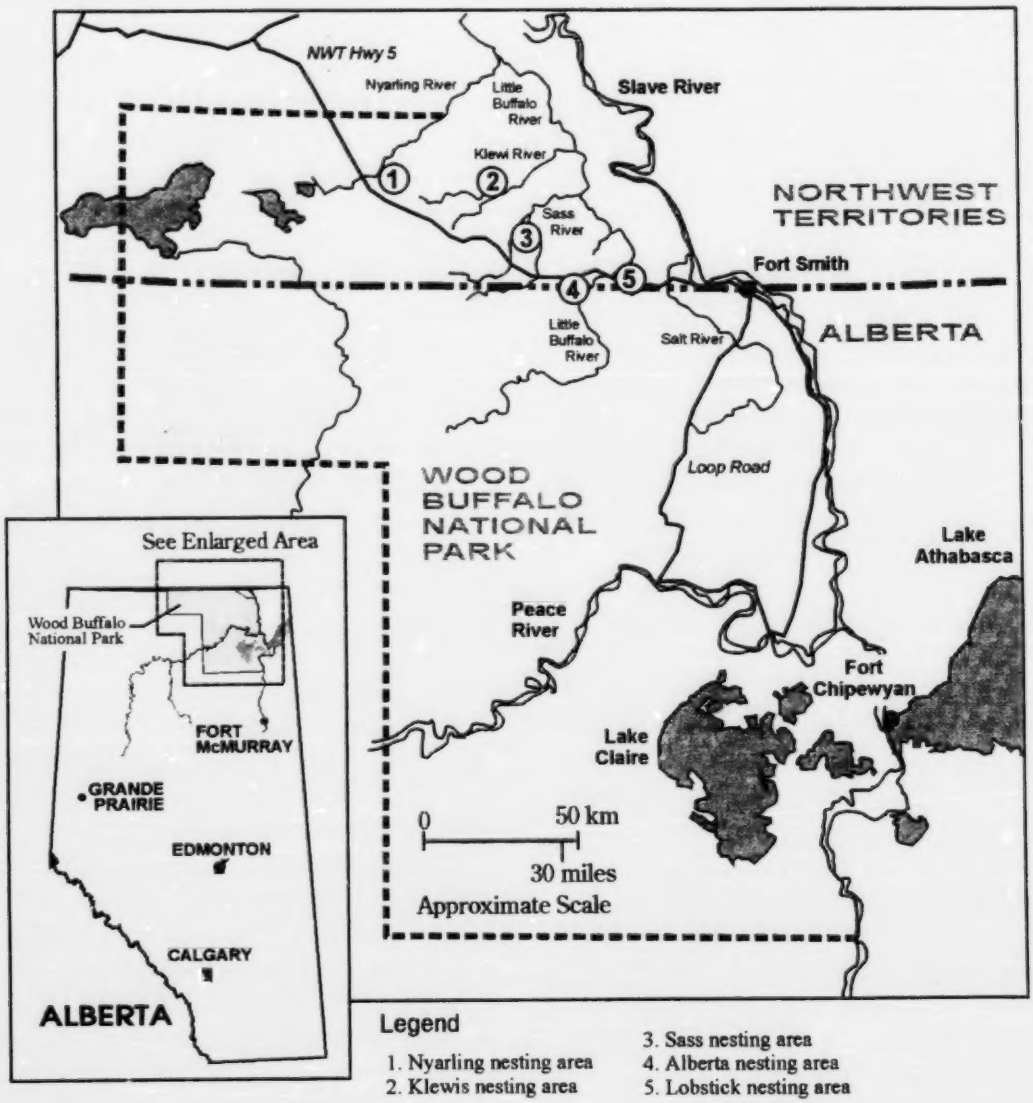

Figure 1. Distribution of Whooping Cranes in Wood Buffalo National Park which includes locations in both Alberta and the Northwest Territories (Kuyt 1993).

Figure 2. Current and former distribution of Whooping Cranes in North America (adapted from Meine and Archibald 1996).

1995, Johns 1998a). The southernmost nesting site ever observed is a pair breeding at 59° 45'N, just within the province of Alberta (Kuyt and Goossen 1987, Kuyt 1993, Kuyt 1995). Nesting has been observed to occur in the large marsh areas surrounding the Little Buffalo River and its tributaries, the Nyarling, Klewi, and Sass Rivers, and Seton Creek (Kuyt and Goossen 1987, Kuyt 1993).

These birds winter on the Gulf coast of Texas, within the Aransas National Wildlife Refuge and adjacent areas (Stehn and Johnson 1987). During their 4500 km migration in the spring and fall, Whooping Cranes pass through Texas, Oklahoma, Kansas, Nebraska, South Dakota, North Dakota, southwestern Manitoba, Saskatchewan, and Alberta (Gollop 1978). The Whooping Cranes fly to west-central Saskatchewan after leaving WBNP for their southward migration. Their migratory territory can include submerged sandbars in the Saskatchewan, Platte, Niobrar, and Red Rivers (Howe 1989, Kuyt 1992). The spring migration begins when the warm southeasterly winds begin flowing in the Gulf of Mexico, usually by the second week of April (Johnsgard 1991). The birds arrive in the Platte Valley of Nebraska where they remain for several days in a different staging area than used on the southward migration, roosting on the Platte River and feeding before proceeding to Saskatchewan and on to Wood Buffalo National Park (Johnsgard 1991, Johns 1992).

A small, isolated, non-migratory flock remained in southwestern Louisiana, near White Lake until 1948, when the last surviving Whooping Crane from this flock was taken into captivity (Doughty 1989, Edwards et al. 1994, Meine and Archibald 1996). An experimental project from 1975 to 1989 attempted to re-introduce Whooping Cranes to the U. S. Rocky Mountains by placing Whooping Crane eggs in Sandhill crane nests at the Grays Lake National Wildlife Refuge, however these birds never successfully reproduced and the experiment was ceased (May 1992, Meine and Archibald 1996). The current focus of reintroduction efforts include a proposed second migratory flock wintering in Florida and breeding in Wisconsin (G. Archibald, pers. comm.) and a non-migratory flock currently being established on the Kissimmee Prairie in Florida (Nesbitt et al. 1997). The Florida Whooping Crane population is only currently reaching sexual maturity and has not as yet successfully reproduced (M. Folk, pers. comm., Meine and Archibald 1996).

*2.2 **Captive Populations***. - A number of Whooping Cranes have been retained in captivity with the hope that their offspring can be released into the wild to begin new migratory and non-migratory wild flocks in the future. The offspring of these captive-bred birds were used in the experimental releases in the United States Rocky Mountains in the 1970s and 1980s, and are currently being released onto the Kissimmee Prairie in Florida.

The majority of captive Whooping Cranes are held in three major North American captive breeding facilities: the Devonian Wildlife Conservation Centre of the Calgary Zoo in Calgary, Alberta, the International Crane Foundation in Baraboo, Wisconsin, and the United States Government Fish and Wildlife Service Patuxent Wildlife Research Centre in Laurel, Maryland. There are also several pairs in smaller captive breeding programs at the Freeport McMoRan Audubon Species Survival Center, in New Orleans, Louisiana, and the San Antonio Zoo.

POPULATION SIZE AND TRENDS

*1. **Alberta.*** - Whooping Cranes have historically had very low population numbers. It is believed that prior to 1870, when anthropogenic activities began to threaten habitat and population numbers, a maximum

of only 1300 to 1400 individuals existed, extending throughout central North America and into the region of north-central Alberta (Allen 1952, Doughty 1989, Kuyt 1996). In 1941, Whooping Cranes reached an overall population low of only 15 migrating birds (Meine and Archibald 1996). Currently, the number of birds that migrate to Wood Buffalo National Park each year is approaching 200 (Figure 3), with approximately six pairs nesting in Alberta in 1999 (B. Johns, pers. comm.).

There exist no specific records as to the number of Whooping Cranes that historically bred in Alberta prior to 1977. Between 1977 and 1987, only one pair was observed to nest inside the Alberta border (B. Johns, pers. comm.). Since 1988, the number of pairs observed nesting in Alberta has fluctuated between one (in 1989 and 1991) and nine (in 1998) (Johns 1998a, B. Johns, pers. comm.).

2 Other areas

2.1 Wild populations. - Conservation efforts began in the early 20th century, when the dwindling populations were first documented (Edwards et al. 1994). By 1941, only 21 individuals remained; 15 individuals in a migratory flock and 6 individuals in a non-migratory flock (Meine and Archibald 1996). The non-migratory flock died out in Louisiana in 1949 (Edwards et al. 1994).

As of March 2001, there were 264 wild Whooping Cranes (T, Stehn pers.comm.). Of

Figure 3. Whooping Crane winter population (1938 - present). Adapted from Meine and Archibald 1996, with additional data from Stehn, US Fish and Widlife Service, pers. comm.

the 264 birds in the wild, 176 belong to the migratory Wood Buffalo-Aransas flock, two remain in the Rocky Mountains as a result of the cross fostering and utlralight experiments of the 1980s and 1990s, and 86 remain from releases in Florida (T. Stehn pers. comm., B. Johns pers. comm.).

Although the population increase is slow, and the species is still extremely vulnerable, the use of computer modeling predicts that the Wood Buffalo – Aransas population is large enough to sustain "fairly steady, though not invariant growth" and the population can be expected to reach 500 individuals in approximately 27 years (Mirande et al. 1991). The Captive Breeding Specialist Group has projected that the Whooping Crane population faces a very low probability of extinction in the next 100 years (Mirande et al. 1991).

2.2 Captive populations. - As of March 2001, there were 120 Whooping Cranes in captivity at five captive breeding facilities in North America (T. Stehn, pers. comm.). The majority of Whooping Cranes are concentrated in three major breeding facilities: Patuxent Wildlife Research Centre in Maryland has 70 birds (44 adults, 26 young); the International Crane Foundation in Wisconsin has 36 birds (29 adults, 7 young); and the Calgary Zoo has 23 birds (21 adults, 2 young; T. Stehn, pers. comm.). The remaining birds are at the White Oak Conservation Center in Florida (1 adult), the Lowry Park Zoo in Florida (1 adult), the San Antonio Zoo (4 adults, 2 young), and the Audubon Institute in New Orleans (2 adults).

LIMITING FACTORS

1. Natural Limiting Factors. - There are a number of genetic and demographic threats directly associated with a species with an extremely small population size, including a decreased resistance to disease, skewed age distributions and sex ratios, and a vulnerability to stochastic occurrences such as storms, disease outbreaks, or other catastrophic events (Meine and Archibald 1996). Both wild and captive cranes are susceptible to a wide variety of infectious or parasitic disease, including salmonellosis, avian tuberculosis, avian cholera, inclusion body disease of cranes (IBDC), crane herpes virus, eastern equine encephalitis, coccidiosis, avian pox, and Newcastle's disease (Carpenter and Derrickson 1987). It is especially important to monitor the offspring from captive flocks to ensure that diseases among captive cranes are not released into the wild populations (Meine and Archibald 1996).

Another important consideration when considering threats to the Whooping Crane population is competition for food and resources among individuals as the slowly increasing population reaches carrying capacity, particularly in the wintering range (Gollop 1978). This can have far-reaching implications. During the winter of 1993-1994, the blue crab populations were exceptionally low on the wintering grounds, and as a result the following spring migration was erratic and 16 pairs failed to nest the next summer (Johns 1998a).

Abiotic factors can play a significant role in the short- or long-term fate of cranes, especially when considering the potential effects of stochastic events on small or highly concentrated populations (Meine and Archibald 1996). Weather events such as storms can cause extensive mortality to crane populations or can lead to setbacks in migration by physically blowing the Whooping Cranes hundreds of kilometers off course (Merrill 1961). For example, a severe storm with hurricane force winds blew through the Canadian prairies and American midwest during the fall migration of 1998, and is

suspected to be responsible for the deaths of several adult individuals (B. Johns, pers. comm.).

Climate change can affect crane populations as well. Periods of drought can dry up critical wetland breeding areas and can also reduce food supplies and increase the vulnerability of chicks and nests to predation events (Kuyt et al. 1992). The threat of global warming and the predicted outcome on the environment has the potential to seriously impact existing crane habitats (Meine and Archibald 1996).

Endangered species with extremely limited abundance, such as Whooping Cranes are especially vulnerable to the threat of predation. Predation on eggs and recently hatched young can reduce the number of viable offspring produced in a season (B. Johns, pers. comm.). Bobcat predation is a source of high mortality for the Whooping Crane flock on the Kissimmee Prairie in Florida (U.S. Fish and Wildlife Service 1998).

Whooping Cranes, having come so close to extinction, are a species particularly in need of management to maximize genetic diversity because the founding gene pool of the existing birds was so limited. A lack of diversity within a species can lead to a reduced disease resistance, a decrease in overall fertility, and an increase in mortality of embryos (Mirande et al. 1996a, 1996b).

2. Habitat Loss and Degradation. - Habitat loss and degradation is one of the major threats to Whooping Crane survival and can ultimately affect their breeding grounds, migration resting points and staging areas, wintering grounds, resident habitats, and roosting areas. Although both the breeding and wintering areas of the migratory flock are in protected areas, the 4500 km migratory path that cranes fly twice a year is not subject to the same protection. Therefore, Whooping Cranes face their greatest threats to habitat loss and degradation during migration.

Conversion of wetlands for development (be it agricultural, urban, commercial, or recreational), oil exploration, or road construction is the most significant threat affecting the overall vulnerability of cranes (Harris 1994). Wetland conversion reduces habitat suitability and availability. Converting this habitat usually involves clearing naturally occurring vegetation, draining or altering hydrologic processes, and burning, cultivation, or other activities, all of which render habitat formerly usable by cranes unsuitable for nesting, feeding, roosting, or stopping during migration (Meine and Archibald 1996). Conversion of grasslands into agricultural land has also had a similar effect of habitat loss to cranes (Meine and Archibald 1996).

It is possible for cranes and humans to successfully coexist, but in some wetland areas the increasing human population growth and economic constraints have overtaxed ecosystems and the resources they provide (Meine and Archibald 1996). Human over-exploitation of plant, animal (particularly fish), and water resources can have a negative impact on cranes as well as other species within the ecosystem, and can ultimately result in the species leaving the area to find more suitable habitat (Meine and Archibald 1996).

The construction of dams and irrigation systems can irreparably alter the hydrologic regime of a landscape, and subsequently affect the stream channels and associated wetlands of river systems that provide critical crane habitat (Meine and Archibald 1996). For example, dams in the northern stretches of the Platte River in Nebraska have altered the natural flood cycle of the area, allowing woody vegetation to take hold in what was once open

riparian zones, reducing the availability of prime roosting sites for Whooping Cranes along their migratory route (Currier 1991).

Urban expansion and land development is a critical issue affecting Whooping Crane habitat. Development of wetlands and other crane habitat for human habitation has restricted the range of the Whooping Crane (Meine and Archibald 1996). The subdivision and development of land can lead to habitat fragmentation. Properties that were once extensive become subdivided and fields, pastures, meadows, and wetlands are subsequently reduced in size and often fenced, which is shown to cause an effective reduction on foraging range for Whooping Cranes (Meine and Archibald 1996).

A significant problem on the wintering grounds of the Whooping Cranes at the Aransas National Wildlife Refuge in Texas is the erosion of coastal marsh vegetation and shoreline soils caused by dredging of channels, and the wave action of boat and barge traffic (Halpern 1992).

Pollution and environmental contamination has the potential to play a significant role in the decline of Whooping Crane populations. Chemicals, organic wastes, and other pollutants can impact overall water quality and subsequently affect crane physiology and reproductive success, as well as affecting the quality and availability of crane food sources within their wetland habitats (Meine and Archibald 1996). The production and transportation of chemicals along coastlines and major rivers make wetlands in these areas exceptionally vulnerable to the potential for a catastrophic pollution event (Meine and Archibald 1996). The Gulf Intracoastal Waterway in Texas, near the Aransas National Wildlife Refuge, is subjected to barge traffic carrying benzene, xylene, and other toxic chemicals on a daily basis; even one small spill in this area could have a devastating outcome on the Whooping Crane wintering population, their habitat, and their food sources (Lewis et al. 1992, Lewis 1995).

Oil development, consisting of exploration, drilling, extraction, transport, and processing, presents a potentially threatening situation with respect to pollution of crane habitats. Oil development activities take place within the Aransas National Wildlife Refuge, however is restricted to the summer months when the Whooping Cranes have migrated to their northern breeding grounds (Meine and Archibald 1996). It is important to realize, though, that an accident or spill at other times of the year could still have a long-term impact on the environmental habitat quality throughout the Aransas reserve (Meine and Archibald 1996). Continuous low level discharge of pollutants related to the production and transportation of oil can also be of concern to the overall well being of Whooping Cranes (Robertson et al. 1993, Lewis 1995).

The accidental collision with power lines during flight can be a significant source of mortality for Whooping Cranes (Brown et al. 1987, Howard et al. 1987, Faanes and Johnson 1992). Relocating, removing, burying, or marking the utility lines can mitigate this threat, although it is an expensive and time-extensive task (Meine and Archibald 1996). Collision with other infrastructure on the landscape, such as fences, can also result in accidental injury or even death (Allen and Ramirez 1990).

3. Hunting. - Overhunting is one of the threats that have led the Whooping Cranes to their current endangered status. Because of a lack of enforced hunting restrictions in the 19th and early 20th century, it is impossible to know exactly how many of the once abundant Whooping Cranes were hunted for sport and

for food (Doughty 1989). Today there are strict hunting regulations enforced in both Canada and the United States, however accidental shooting due to misidentification and poaching are still of concern.

STATUS DESIGNATIONS

1. Alberta. - According to the *Status of Wild Species in Alberta* 2000 (in prep), Whooping Cranes are considered 'At Risk' in the province (see Appendix 1 for status definitions) because of small population size and localized breeding and wintering habitat. The Whooping Crane has been a 'Red-Listed'(at risk) species in Alberta since 1991 (Alberta Wildlife Management Division 1996). The species is also designated as an 'endangered' animal under the Alberta Wildlife Act. The Natural Heritage Element Rarity Rank for the Whooping Crane in Alberta is S1 (ANHIC 2001).

2. Other areas. - By the time awareness of the dwindling Whooping Crane populations reached government, the species was in grave danger of extinction. To ensure the species had a chance of survival, it was first necessary to protect their critical breeding and wintering habitat and cease hunting. In 1916, the Migratory Birds Convention Act was passed which allowed for the outright ban of hunting of Whooping Cranes (Gollop 1978, RENEW 1998).

COSEWIC (the Committee on the Status of Endangered Wildlife in Canada) listed the Whooping Crane as 'endangered' in 1978, the first year that such designations were made (RENEW 1998). The Whooping Crane remains on the COSEWIC list of endangered species today (COSEWIC 2001). The United States formally declared the Whooping Crane to be endangered several years earlier, in 1967 (RENEW 1998). The Whooping Crane's Global Heritage Status according to Nature Serve (2000) is G1 (Appendix 1). In the United States this species is ranked LE (Listed Endangered), and XN(non-essential experimental population) (US Fish and Wildlife Service, 2001). The International Union for the Conservation of Nature and Natural Resources (IUCN), an organization which encompasses many of the world's conservation agencies and institutions (both governmental and non-governmental), classified the Whooping Crane as endangered in 1996.

RECENT MANAGEMENT IN ALBERTA

In 1937, the Aransas National Wildlife Refuge was established in Texas to protect the Whooping Cranes' wintering grounds (Doughty 1989). A search began to discover the elusive cranes' northern breeding grounds, and in 1954 after ten years of extensive searching they were finally discovered (Allen 1956, Doughty 1989, McCoy 1996). The Whooping Cranes' breeding grounds were within the boundaries of Canada's Wood Buffalo National Park, a parcel of land that had been protected since 1922.

The current increase in population is due to many interacting factors, including an intensified public awareness campaign to reduce accidental shooting, the legal protection of the species and its critical breeding and wintering habitat, and the extensive captive breeding programs, that the Whooping Crane population numbers have reached the levels they have today.

While there are no Whooping Crane management initiatives currently undertaken by the province of Alberta, there are a number of federal (Canadian and American) management programs in effect.

In 1988, Canada adopted a national recovery plan for the species, which consisted of a number of goals and specific objectives for the conservation of Whooping Cranes (Edwards et al. 1994). The primary objectives of the recovery plan were to establish a stable or increasing Wood Buffalo-Aransas migrating population with a minimum of 40 breeding adult pairs for 10 consecutive years (an objective which has been consistently attained from 1995 to the present) and to establish and support two additional wild Whooping Crane populations, each with a minimum of 25 breeding adult pairs by the year 2020 (Edwards et al. 1994). Only when these population objectives have been maintained for 10 consecutive years, will the recovery plan be a success (Edwards et al. 1994). Once this has occurred, recovery efforts will be required to eventually remove the Whooping Crane from the COSEWIC list (Edwards et al. 1994).

The Canadian Wildlife Service regularly surveys the breeding grounds throughout the summer months to monitor the cranes' breeding population and productivity (Gollop 1978). On the wintering grounds, it is the responsibility of the US Fish and Wildlife Service to monitor the Whooping Crane population (Gollop 1978). A "Memorandum of Understanding" exists between the Canadian Wildlife Service and the US Fish and Wildlife Service, which officially documents the cooperative effort required in the management of the Whooping Crane, an internationally migratory species (Edwards et al. 1994). This memorandum serves to improve coordination and cooperation in Whooping Crane management, research, and conservation (Edwards et al. 1994). This is essential to improve the cranes' quality of habitat and survival rate, to enhance and maximize management programs in both countries while avoiding duplication of effort, to improve existing practices for exchanging information, individual birds, and eggs, and to allow for the creation of new flocks and wild populations (Edwards et al. 1994).

Whooping Crane management in North America is focused on two separate and distinct areas: management of the wild and migrating crane populations, and management of the cranes in captive breeding programs. It is important that both of these distinct managerial issues be considered together. Without the capture of wild adults or the removal of eggs from nests in the wild, it would be impossible to have the three captive populations that exist today. Conversely, without the captive-bred animals, the establishment of additional wild populations would be impossible. Captive-bred birds released into new wild populations can help counteract population losses to biological processes including predation, disease, and death, environmental catastrophes such as storms, and anthropogenic interference.

Academics, corporate sponsors, governmental agencies, and environmental non-governmental organizations have worked together to provide the funding and research required to gain the level of understanding about the species that we have today.

SYNTHESIS

The most critical issue in the management of Whooping Cranes is their low population size, which is currently over 200 individuals in the wild, but still remains an extremely vulnerable population, with a number of anthropogenic, biological, and environmental factors threatening the stability and overall viability of the species. In order to successfully manage the species, we must first mitigate the anthropogenic threats to Whooping Cranes, including continued habitat loss and degradation, wetland conversion, over-exploitation of wetland resources, agricultural

conversion of grasslands, creation of dams and water diversions, land development and urban expansion, coastal marsh and shoreline erosion, pollution and contamination, and oil exploration and development (Meine and Archibald 1996). In addition to mitigating these threats, it is still critical to bring the wild population to a sufficient size and to establish more than one biologically self-sustaining and therefore viable wild population in order to allow for population losses as a result of non-mitigable threats such as biological or environmental catastrophes.

Whooping Cranes have survived as a species, despite reaching a population low of only twenty-one individuals almost sixty years ago. The Canadian national recovery plan for the Whooping Crane deals with breeding and migratory issues, and the American national recovery plan covers wintering and migratory issues. The Canadian Wildlife Service and the U.S. Government Fish and Wildlife Service completed a memorandum of understanding that combines the separate goals and objectives of both recovery plans into related goals and objectives related to the establishment of additional wild populations.

It is important to continue coordinating captive management efforts to preserve genetic diversity among Whooping Cranes, for it is the chicks reared from captive flocks that are used to supplement the wild populations (Mirande et al. 1996b). In the future, these practices may lead to a series of self-sustaining wild populations and captive breeding will no longer be required.

In order to have a continued population increase, it is necessary to devote research time and financial support to the minimization and mitigation of anthropogenic threats to the species. It is also important to be able to enact the existing contingency plans in the instance of non-mitigable environmental and biological threats. With careful management of both the wild and captive populations of Whooping Cranes, and with wildlife managers dedicated to attaining the goals and objectives outlined within the recovery plans, we can be hopeful that the species will slowly continue to increase. For the time being, we can be confident that the Whooping Crane is an endangered species that is being well managed and it is this management that is allowing its rebound from near-extinction in the early 20th century.

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APPENDIX 1. Definitions of selected legal and protective designations.

A. Status of Alberta Wildlife rank lists (after Alberta Wildlife Management Division 2000)

2000 Rank	1996 Rank	Definitions
At Risk	Red	Any species known to be at risk after formal assessment and designation as Endangered in Alberta or in Canada (in the part of the range that includes Alberta).
May be at Risk	Blue	Any species believed to be at risk. These species will require a detailed assessment for possible formal designation as Endangered or Vulnerable.
Sensitive	Yellow	Any species known to be, or believed to be, particularly sensitive to human activities or natural events.
Secure	Green	Any species known to be, or believed to be, not at risk.
Status Undetermined	Status Undetermined	Any species where not enough information exists to adequately use the ranking system (exceptional cases only).
Not Assessed	n/a	Any species known or believed to be present but which have not yet been evaluated.
Exotic/Alien	n/a	Any species that have been introduced as a result of human activity.
Extirpated/Extinct	n/a	Any species no longer thought to be present in the jurisdiction or are believed to be extinct.
Accidental/Vagrant	n/a	Any species occurring infrequently and unpredictably outside their usual range.

B. Alberta Wildlife Act

Species designated as 'endangered' under the Alberta Wildlife Act include those defined as 'endangered' or 'threatened' by *A Policy for the Management of Threatened Wildlife in Alberta* (Alberta Fish and Wildlife 1985):

Endangered	A species whose present existence in Alberta is in danger of extinction within the next decade.
Threatened	A species that is likely to become endangered if the factors causing its vulnerability are not reversed.

C. United States Endangered Species Act (after National Research Council 1995)

Endangered	Any species which is in danger of extinction throughout all or a significant portion of its range.
Threatened	Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

D. Committee on the Status of Endangered Wildlife in Canada (after COSEWIC 2001)

Extinct	A wildlife species that no longer exists.
Extirpated	A wildlife species that no longer exists in the wild in Canada, but exists elsewhere in the wild.
Endangered	A wildlife species that is facing imminent extirpation or extinction.
Threatened	A wildlife species that is likely to become an endangered species if nothing is done to reverse the factors leading to its extirpation or extinction.
Special Concern (Vulnerable)	A wildlife species of special concern because it is particularly sensitive to human activities or natural events, but does not include an extirpated, endangered or threatened species.
Not at Risk	A wildlife species that has been evaluated and found to be not at risk.
Indeterminate	A species for which there is insufficient scientific information to support status designations.

E. Heritage Status Ranks (after Nature Serve 2000)

G1/S1	**Critically Imperiled**: Critically imperiled globally because of extreme rarity or because of some factor(s) making it especially vulnerable to extinction. Typically 5 or fewer occurrences or very few remaining individuals (<1,000) or acres (<2,000) or linear miles (<10).
G2/S2	**Imperiled**: Imperiled globally because of rarity or because of some factor(s) making it very vulnerable to extinction or elimination. Typically 6 to 20 occurrences or few remaining individuals (1,000 to 3,000) or acres (2,000 to 10,000) or linear miles (10 to 50).
G3/S3	**Vulnerable**: Vulnerable globally either because very rare and local throughout its range, found only in a restricted range (even if abundant at some locations), or because of other factors making it vulnerable to extinction or elimination. Typically 21 to 100 occurrences or between 3,000 and 10,000 individuals.
G4/S4	**Apparently Secure**: Uncommon but not rare (although it may be rare in parts of its range, particularly on the periphery), and usually widespread. Apparently not vulnerable in most of its range, but possibly cause for long-term concern. Typically more than 100 occurrences and more than 10,000 individuals.
G5/S5	**Secure**: Common, widespread, and abundant (although it may be rare in parts of its range, particularly on the periphery). Not vulnerable in most of its range. Typically with considerably more than 100 occurrences and more than 10,000 individuals.
GX/SX	**Presumed Extirpated**—Element is believed to be extirpated from the nation or subnation*. Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.
GH/SH	**Possibly Extirpated** (Historical)—Element occurred historically in the nation or subnation*, and there is some expectation that it may be rediscovered. Its presence may not have been verified in the past 20 years. An element would become NH or SH without such a 20-year delay if the only known occurrences in a nation or subnation were destroyed or if it had been extensively and unsuccessfully looked for. Upon verification of an extant occurrence, NH or SH-ranked elements would typically receive an N1 or S1 rank. The NH or SH rank should be reserved for elements for which some effort has been made to relocate occurrences, rather than simply using this rank for all elements not known from verified extant occurrences.

F. US Endangered Species Status Designations (US Fish and Wildlife Service 2001)

LE	Listed endangered
LT	Listed threatened
PE	Proposed endangered
PT	Proposed threatened
C	Candidate
PDL	Proposed for delisting
E(S/A) or T(S/A)	Listed endangered or threatened because of similarity of appearance
XE	Essential experimental population
XN	Nonessential experimental population
Null value	Usually indicates that the taxon does not have any federal status. However, because of potential lag time between publication in the Federal Register and entry in the Central Databases and refresh of this website, some taxa may have a status which does not yet appear.

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